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Prevalence of Hypertension and its Associated Factors among Patients with Diabetes in Dongola Specialized Hospital Northern State, Sudan, 2026

A Proposal Submitted in Partial Fulfillment for the Requirements of the Degree of Bachelor of Medicine & Bachelor Surgery (MBBS)

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1. INTRODUCTION

1.1 Background Information

Diabetes mellitus (DM) and hypertension (HTN) are among the most prevalent chronic non-communicable diseases (NCDs) worldwide and frequently coexist, representing a major and growing public health challenge [1]. Over recent decades, the global prevalence of both conditions has increased substantially, driven by rapid urbanization, population aging, dietary transitions, and increasingly sedentary lifestyles [2]. Hypertension is particularly common among individuals with type 2 diabetes mellitus (T2DM); according to the International Diabetes Federation (IDF), it affects approximately 50–80% of patients with diabetes, with variation across regions, ethnic groups, and clinical settings [3].

The coexistence of DM and HTN produces a synergistic increase in cardiovascular risk, substantially raising the likelihood of both macrovascular complications—including coronary artery disease, stroke, and peripheral vascular disease—and microvascular complications, such as diabetic nephropathy, retinopathy, and neuropathy [4]. Several interrelated pathophysiological mechanisms contribute to elevated arterial pressure in patients with diabetes, including hyperinsulinemia, insulin resistance, increased renal sodium retention, and heightened vascular tone [5]. In sub-Saharan Africa, including Sudan, the combined burden of DM and HTN is increasing rapidly amid constrained healthcare infrastructure, limited early screening and diagnostic services, and inconsistent availability of essential medications. Non-communicable diseases are increasingly becoming a leading cause of mortality in the WHO African Region, while hypertension control remains low across the region [6].

Despite growing evidence of the high frequency and clinical consequences of DM–HTN comorbidity, the magnitude, determinants, and management

outcomes of this dual burden remain insufficiently characterized in Sudan. Available studies suggest that hypertension is common among Sudanese patients with diabetes, with reported prevalence estimates ranging from approximately 45.6% to 47.6%, yet much of the evidence is limited to single facilities or specific geographic areas and may not reflect the broader patient population. Furthermore, undiagnosed hypertension remains an important concern in Sudan, partly because routine blood-pressure screening and public awareness are limited. Health-system studies also report inadequate availability of NCD services, medicines, laboratory support, trained staff, patient education, and organized follow-up, all of which may compromise the identification and control of comorbid DM and HTN [7]. Therefore, there is a need for up-to-date, locally relevant evidence on the prevalence, associated factors, and management of hypertension among patients with diabetes in Sudan.

1.2 Problem Statement

Patients with coexisting DM and HTN require early screening and optimal clinical control to prevent severe cardiovascular, renal, and neurological complications. In contrast, Sudan faces a staggeringly high HTN prevalence of 45.6% to 47.6% among patients with diabetes, which is currently exacerbated by suboptimal blood pressure control, health system disruptions, mass displacement, and a profound scarcity of recent, localized evidence on the true magnitude and determinants of this co-morbidity [7]. Consequently, this data void and lack of management lead to delayed diagnoses, poorly managed risk factors, and a surge in preventable, high-cost complications. Therefore, there is an urgent need to assess the prevalence, determinants, and management of HTN among diabetic patients in Sudan to inform targeted clinical and public health interventions.

1.3 Justification

Hypertension is highly prevalent among patients with diabetes mellitus in Northern State, Sudan, and its coexistence with diabetes substantially increases

the risk of serious cardiovascular, renal, and microvascular complications. However, local evidence on the magnitude, determinants, screening, treatment, and control of hypertension among diabetic patients remains limited [7]. Identifying high-risk groups and modifiable factors will support early detection, routine blood-pressure screening, and integrated management of both conditions. The findings may help health authorities and clinicians strengthen diabetes care, improve treatment adherence, and reduce preventable complications in Northern State.

1.4 Research Objectives

1.4.1 General Objective

To estimate the prevalence of hypertension and identify its associated factors among patients with diabetes attending Dongola Specialized Hospital, Northern State, Sudan, in 2026.

1.4.2 Specific Objectives

1. To estimate the prevalence of hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital.
2. To determine the association between sociodemographic characteristics and hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital.
3. To determine the association between clinical characteristics and hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital.
4. To identify lifestyle factors associated with hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital.

1.5 Research Questions

1. What is the prevalence of hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital?

2. Is there an association between sociodemographic characteristics and hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital?
3. Is there an association between clinical characteristics and hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital?
4. Which lifestyle factors are associated with hypertension among patients with diabetes mellitus attending Dongola Specialized Hospital?

2. Literature Review

The co-occurrence of hypertension among patients with diabetes mellitus has been extensively documented at global, regional, and national levels, consistently demonstrating a substantial burden of disease. In a cross-sectional study conducted in Khartoum, Sudan, Abdelbagi et al. (2021) investigated the frequency of hypertension among patients with type 2 diabetes mellitus attending outpatient clinics. The study reported a hypertension prevalence of 63.5% among patients with diabetes. Advanced age (>55 years), prolonged diabetes duration (>10 years), and higher body mass index (≥30 kg/m²) were independently and significantly associated with poor blood-pressure control [1].

Similarly, Almobarak et al. (2019) assessed cardiovascular risk factors among urban and semi-urban Sudanese populations with diabetes. Their findings showed that more than 58% of patients with diabetes had coexisting hypertension, while physical inactivity and high dietary sodium intake were identified as important modifiable behavioral factors. The authors emphasized the need for decentralized, community-based screening for cardiovascular risk factors among patients with diabetes across Sudan [2].

At the regional level, Saasita et al. (2023) conducted a systematic review and meta-analysis on the burden of hypertension among patients with diabetes in East and Central Africa. Based on 24 observational studies, the pooled prevalence of hypertension among patients with type 2 diabetes was 56.8% (95% CI: 52.1–61.4%). Older age, abdominal obesity, a positive family history of cardiovascular disease, and non-adherence to dietary recommendations were significantly associated with higher odds of hypertension [3].

Evidence from international settings also supports the high burden of this comorbidity. Observational studies from Middle Eastern and Asian countries have reported hypertension prevalence rates ranging from 50% to 75% among patients with diabetes, reflecting the global consistency of this dual burden [4].

Taken together, the available literature indicates that although non-modifiable

factors such as age and genetic predisposition contribute to hypertension risk, modifiable lifestyle behaviors and clinical control indicators remain important targets for public health and clinical interventions [5].

However, variations in dietary practices, healthcare access, socioeconomic conditions, and health-system capacity across regions highlight the need for localized evidence. Therefore, this study was conducted in Dongola, Northern State, Sudan, to provide up-to-date evidence on the prevalence and determinants of hypertension among patients with diabetes attending Dongola Specialized Hospital.

3. Materials and Methods

3.1 Study Design

A descriptive cross-sectional hospital -based study design will be conducted during October and November.

3.2 Study Area

The study will be conducted at the Outpatient Clinic of Dongola Specialized Hospital, which located in Dongola, the capital of Northern State, Sudan. Dongola Specialized Hospital is the major secondary referral institution in the state, offering specialized medical care, outpatient services, and emergency care to populations from Dongola and surrounding rural localities

3.3 Study Population

3.3.1 Inclusion Criteria: the participants will be

- Patients diagnosed with Type 2 Diabetes Mellitus for at least 6 months prior to the study.
- Adults aged 18 years and older.
- Permanent residents of Northern State (residing in the state for ≥ 6 months).
- Patients who provide informed voluntary written or verbal consent to participate.

3.3.2 Exclusion Criteria: Patients were excluded if they:

- Critically ill patients or individuals unable to communicate due to severe acute illness or cognitive impairment.
- Patients unable to communicate in Arabic language.

3.4 Sample Size

The sample size (n) will be calculated using Cochran's formula for single population proportions

$$\mathbf{n = (Z2 \cdot p \cdot (1 - p)) / d2}$$

Where:

n = Required sample size.

Z = Standard normal deviation corresponding to a 95% confidence interval (Z = 1.96).

p = Estimated prevalence of hypertension among patients with diabetes in Sudan, taken as 50% (p = 0.50) to yield the maximum sample size.

d = Margin of error set at 5% (d = 0.05).

n = ((1.96)2 · 0.50 · 0.50) / (0.05)2 = (3.8416 · 0.25) / 0.0025 = 384.16

To account for potential non-response, incomplete questionnaires, or missing measurements, an additional 10% nonresponse buffer will be added, establishing a total target sample size of approximately 424 participants.

3.5 Sampling Technique

A simple random sampling method will be used to recruit participants. Eligible patients will be invited randomly to participate face-to-face questionnaire-guided interview.

3.6 Data Collection

Data will be collected using a structured, interviewer-administered questionnaire adapted from the World Health Organization (WHO) STEPwise approach to surveillance of non-communicable disease risk factors. The questionnaire will be administered in Arabic and will include closed-ended questions to ensure consistency and facilitate data analysis.

The questionnaire will consist of four main sections: sociodemographic characteristics, clinical characteristics, behavioral and lifestyle factors, and anthropometric and blood-pressure measurements.

Operational Definition of Hypertension:

Participants will be defined as hypertensive if they have a confirmed prior clinical diagnosis of hypertension and are currently receiving regular antihypertensive therapy.

3.7 Study Variables

3.7.1 Dependent Variable

Prevalence of Hypertension.

3.7.2 Independent Variables

The independent variables included sociodemographic factors (age, sex, marital status, educational level, occupational status, monthly income, and residence), clinical factors (duration of diabetes mellitus, type of antidiabetic medication, and family history of hypertension or cardiovascular disease), and lifestyle factors (smoking status, physical activity level, and dietary salt intake).

3.7 Data Analysis Plan

Data will be checked for completeness, cleaned, coded, and entered into SPSS Statistics (version 26.0 or higher) for analysis.

Descriptive statistics will be used to summarize the characteristics of the study participants. Continuous variables will be presented as mean ± standard deviation (SD) if normally distributed, or as median with interquartile range (IQR) if not normally distributed. Categorical variables will be summarized as frequencies and percentages.

Inferential statistics will be used to assess the association between independent variables and hypertension. Cross-tabulations will be performed, and the chi-square test will be used to determine associations between categorical independent variables and hypertension status. Variables with a p-value less than 0.20 in the bivariate analysis will be entered into the multivariable binary logistic regression model to identify independent predictors of hypertension.

The results of the multivariable analysis will be reported as adjusted odds ratios (AOR) with 95% confidence intervals (CI). A two-tailed p-value of less than 0.05 will be considered statistically significant.

3.8 Ethical Approval

Ethical approval will be obtained through a sequential regulatory approval process. First, ethical clearance will be obtained from the Research Ethics Committee of the Faculty of Medicine and Health Sciences, University of Dongola. Subsequently, administrative approval will be obtained from the

Northern State Ministry of Health, followed by facility-level authorization from the administration of Dongola Specialized Hospital.

Informed voluntary written consent, will be obtained from each participant before data collection. Participants will be provided with clear information about the purpose of the study, the procedures involved, potential risks and benefits, and their right to withdraw at any time without any consequence. Participation will be entirely voluntary, and refusal to participate will not affect the quality or availability of medical care.

4. STUDY PLAN AND BUDGET

4.1 Study Plan

Below are the study activities and their planned date from proposal preparation to final complete thesis submission and defense.

Table 1: Study activities along with their planed dates.

Activities/Months	September	October	November	December	January
Submission & presentation of Research Proposal					
Data Collection					
Data Analysis					
Writing the Final Report					
Submission of Research to the Department of Community Medicine					
Research Discussion / Defense					

4.2 Study Plan

Below are the study budgetary breakdown and their estimated cos in Sudanese pound (SDG).

Table 1: Study budgetary breakdown along with their estimated costs in SDG.

NO	BUDGETARY BREAKDOWN	ESTIMATED COST (SDG)
1	Printing	70,000
2	Transportation	100,000
3	Internet	110,000
4	Stationery	20,000
5	Data Entry & Analysis	150,000
6	Other Expenses	50,000
7	**TOTAL**	**500,000**

5. REFERENCES:

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